

## CLAIMS

What is claimed is:

1. A method of forming a double-sided capacitor, comprising:  
forming at least one opening in an insulating layer on a semiconductor wafer;  
forming a sacrificial liner along sidewalls of the at least one opening;  
forming a first conductive layer over the sacrificial liner, the first conductive layer having a first surface and a second surface, wherein the first surface of the first conductive layer contacts the sacrificial liner;  
selectively removing the sacrificial liner to expose the first surface of the first conductive layer;  
forming a dielectric layer over the first and second surfaces of the first conductive layer; and  
forming a second conductive layer over the dielectric layer.
2. The method of claim 1, wherein forming a sacrificial liner in the at least one opening comprises forming the sacrificial liner from a material selected from the group consisting of titanium nitride, polysilicon, and hemispherical grain polysilicon.
3. The method of claim 1, wherein forming a sacrificial liner in the at least one opening comprises forming the sacrificial liner from titanium nitride.
4. The method of claim 3, wherein selectively removing the sacrificial liner to expose the first surface of the first conductive layer comprises removing the sacrificial liner using a solution of hydrogen peroxide and sulfuric acid.
5. The method of claim 1, wherein forming a sacrificial liner in the at least one opening comprises forming the sacrificial liner from polysilicon or hemispherical grain polysilicon.
6. The method of claim 5, wherein selectively removing the sacrificial liner to expose the first surface of the first conductive layer comprises removing the sacrificial liner using a solution of tetramethylammonium hydroxide.

7. The method of claim 1, wherein forming a sacrificial liner in the at least one opening comprises depositing the sacrificial liner by chemical vapor deposition.
8. The method of claim 1, wherein forming a first conductive layer over the sacrificial liner comprises forming a bottom electrode of the double-sided capacitor.
9. The method of claim 1, wherein forming a first conductive layer over the sacrificial liner comprises forming the first conductive layer from titanium nitride or polysilicon.
10. The method of claim 1, wherein selectively removing the sacrificial liner to expose the first surface of the first conductive layer comprises removing the sacrificial liner without damaging exposed components on the semiconductor wafer.
11. The method of claim 1, wherein selectively removing the sacrificial liner to expose the first surface of the first conductive layer comprises removing the sacrificial liner without removing the first conductive layer.
12. The method of claim 1, wherein selectively removing the sacrificial liner to expose the first surface of the first conductive layer comprises forming an open space adjacent to the first surface of the first conductive layer.
13. The method of claim 12, further comprising increasing a thickness of the open space by removing at least a portion of the insulating layer.
14. The method of claim 13, wherein removing at least a portion of the insulating layer comprises etching the at least a portion of the insulating layer using a solution of hydrogen fluoride.
15. The method of claim 1, wherein forming a dielectric layer over the first and second surfaces of the first conductive layer comprises depositing an insulative material over the first and second surfaces of the first conductive layer.

16. The method of claim 1, wherein forming a second conductive layer over the dielectric layer comprises forming a top electrode of the double-sided capacitor.

17. A method of forming a double-sided capacitor having increased capacitance, comprising:  
forming a first opening in a first insulating layer on a semiconductor wafer;  
forming a first sacrificial liner along sidewalls of the first opening;  
forming a sacrificial plug adjacent to the first sacrificial liner, the sacrificial plug formed from a material having a different etch selectivity than a material used in the first sacrificial liner;  
forming a second insulating layer over the first insulating layer;  
forming a second opening in the second insulating layer, the second opening in substantial alignment with the first opening;  
forming a second sacrificial liner along sidewalls of the second opening;  
removing the sacrificial plug;  
forming a first conductive layer over the first and second sacrificial liners, the first conductive layer having a first surface and a second surface, wherein the first surface of the first conductive layer contacts the first and second sacrificial liners;  
selectively removing the first and second sacrificial liners to expose the first surface of the first conductive layer;  
forming a dielectric layer over the first and second surfaces of the first conductive layer; and  
forming a second conductive layer over the dielectric layer.

18. The method of claim 17, wherein forming a first sacrificial liner along sidewalls of the first opening comprises forming the first sacrificial liner from a material selected from the group consisting of titanium nitride, polysilicon, and hemispherical grain polysilicon.

19. The method of claim 17, wherein forming a first sacrificial liner along sidewalls of the first opening comprises depositing the first sacrificial liner by chemical vapor deposition.

20. The method of claim 17, wherein forming a first sacrificial liner along sidewalls of the first opening comprises forming the first sacrificial liner from titanium nitride.

21. The method of claim 20, wherein forming a sacrificial plug adjacent to the first sacrificial liner comprises forming the sacrificial plug from polysilicon or hemispherical grain polysilicon.

22. The method of claim 17, wherein forming a first sacrificial liner along sidewalls of the first opening comprises forming the sacrificial liner from polysilicon or hemispherical grain polysilicon.

23. The method of claim 22, wherein forming a sacrificial plug adjacent to the first sacrificial liner comprises forming the sacrificial plug from titanium nitride.

24. The method of claim 17, wherein forming a second sacrificial liner along sidewalls of the second opening comprises forming the second sacrificial liner from a material selected from the group consisting of titanium nitride, polysilicon, and hemispherical grain polysilicon.

25. The method of claim 17, wherein removing the sacrificial plug comprises removing the sacrificial plug without removing the first and second sacrificial liners.

26. The method of claim 25, wherein removing the sacrificial plug comprises removing the sacrificial plug using a solution of hydrogen peroxide and sulfuric acid or a solution of tetramethylammonium hydroxide.

27. The method of claim 17, wherein selectively removing the first and second sacrificial liners to expose the first surface of the first conductive layer comprises removing the first and second sacrificial liners using a solution of hydrogen peroxide and sulfuric acid or a solution of tetramethylammonium hydroxide.

28. The method of claim 17, wherein selectively removing the first and second sacrificial liners to expose the first surface of the first conductive layer comprises removing the first and second sacrificial liners without damaging exposed components on the semiconductor wafer.

29. The method of claim 17, wherein selectively removing the first and second sacrificial liners to expose the first surface of the first conductive layer comprises removing the first and second sacrificial liners without removing the first conductive layer.

30. The method of claim 17, wherein selectively removing the first and second sacrificial liners to expose the first surface of the first conductive layer comprises forming an open space adjacent to the first surface of the first conductive layer.

31. The method of claim 17, wherein forming a first conductive layer over the first and second sacrificial liners comprises forming the first conductive layer from titanium nitride or polysilicon.

32. The method of claim 17, wherein forming a dielectric layer over the first and second surfaces of the first conductive layer comprises depositing an insulative material over the first and second surfaces of the first conductive layer.

33. The method of claim 30, further comprising increasing a thickness of the open space by removing at least a portion of the insulating layer.

34. The method of claim 33, wherein removing at least a portion of the insulating layer comprises etching the at least a portion of the insulating layer using a solution of hydrogen fluoride.

35. The method of claim 17, wherein forming a dielectric layer over the first and second surfaces of the first conductive layer comprises depositing an insulative material over the first and second surfaces of the first conductive layer.

36. The method of claim 17, wherein forming a second conductive layer over the dielectric layer comprises forming a top electrode of the double-sided capacitor.

37. A method of forming a contact, comprising:  
forming a first opening in a first insulating layer on a semiconductor wafer;  
forming a sacrificial liner along sidewalls of the first opening;  
forming a sacrificial plug in the first opening and adjacent to the sacrificial liner;  
forming a second insulating layer over the first insulating layer;  
forming a second opening in the second insulating layer, the second opening in substantial alignment with the first opening;  
removing either the sacrificial plug or the sacrificial plug and the sacrificial liner from the first opening; and  
depositing a conductive material in the first and second openings.

38. The method of claim 37, wherein forming a sacrificial liner along sidewalls of the first opening comprises forming the sacrificial liner from a material selected from the group consisting of titanium nitride, polysilicon, and hemispherical grain polysilicon.

39. The method of claim 37, wherein forming a sacrificial liner along sidewalls of the first opening comprises depositing the sacrificial liner by chemical vapor deposition.

40. The method of claim 37, wherein forming a sacrificial liner along sidewalls of the first opening comprises forming the sacrificial liner from titanium nitride.

41. The method of claim 40, wherein forming a sacrificial plug in the first opening and adjacent to the sacrificial liner comprises forming the sacrificial plug from polysilicon or hemispherical grain polysilicon.

42. The method of claim 37, wherein forming a sacrificial liner along sidewalls of the first opening comprises forming the sacrificial liner from polysilicon or hemispherical grain polysilicon.

43. The method of claim 42, wherein forming a sacrificial plug in the first opening and adjacent to the sacrificial liner comprises forming the sacrificial plug from titanium nitride.

44. The method of claim 37, wherein removing either the sacrificial plug or the sacrificial plug and the sacrificial liner from the first opening comprises removing either the sacrificial plug or the sacrificial plug and the sacrificial liner without damaging exposed components on the semiconductor wafer.

45. The method of claim 37, wherein removing either the sacrificial plug or the sacrificial plug and the sacrificial liner from the first opening comprises removing either the sacrificial plug or the sacrificial plug and the sacrificial liner using a solution of hydrogen peroxide and sulfuric acid or a solution of tetramethylammonium hydroxide.

46. An intermediate semiconductor device structure, comprising:  
a semiconductor wafer comprising at least one opening in a first insulating layer thereof, the semiconductor wafer defining a precursor structure to a double-sided capacitor, including:  
a sacrificial liner in contact with sidewalls of the at least one opening; and  
a bottom electrode having a first surface and a second surface, the first surface in contact with the sacrificial liner.

47. An intermediate semiconductor device structure, comprising:  
a semiconductor wafer comprising at least one opening in a first insulating layer thereof, the semiconductor wafer defining a precursor structure to a double-sided capacitor, including:  
a first sacrificial liner in contact with sidewalls of the at least one opening in the first insulating layer;  
a sacrificial plug in contact with the first sacrificial liner;  
at least one opening in a second insulating layer; and  
a second sacrificial liner in contact with sidewalls of the at least one opening in the second insulating layer.

48. An intermediate semiconductor device structure, comprising:  
a semiconductor wafer comprising at least one opening in a first insulating layer thereof, the  
semiconductor wafer defining a precursor structure to a contact, including:  
a first sacrificial liner in contact with sidewalls of the at least one opening in the first insulating  
layer;  
a sacrificial plug in contact with the first sacrificial liner; and  
at least one opening in a second insulating layer.